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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

VERIFICATION OF TRANSLATION

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Sir:

I, Atsunori Murata, of 1-14 Higashi-hiratsuka-cho, Naka-ku, Hiroshima 730-0025 declare:

(1) that I know well both the Japanese and English languages;

(2) that I translated the Japanese document entitled "Ink cartridge for use with an ink jet recording apparatus" from Japanese to English;

(3) that the attached English translation is a true and correct translation of the above-identified Japanese document to the best of my knowledge and belief; and

(4) that all statements made of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements are made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 USC 1001, and that such false statements may jeopardize the validity of the application or any patent issuing thereon.

Dated: October 21,2002

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[Name of Document] Specification
[Title of the Invention] Ink cartridge for use with an inkjet recording apparatus

What is claimed is:

[Claim 1] An ink cartridge for use with an inkjet recording apparatus, comprising:
an ink cartridge composed from a container body that stores a porous member for absorbing and holding ink in an ink chamber communicating via an ink supply port and a lid member that seals an opening portion of said container body, and a spacer that is inserted into a gap between said lid member and said porous member.

[Claim 2] The ink cartridge for use with an ink jet recording apparatus, according to claim 1, wherein an ink injecting port and an air communicating port are formed in said lid, and through holes are formed in said spacer, at least, in a position facing said ink injecting port.

[Claim 3] The ink cartridge for use with an ink jet recording apparatus, according to claim 2, wherein said through holes are prepared at a number of symmetrical positions so as to face said ink injecting port, regardless of the direction of said spacer.

[Claim 4] The ink cartridge for use with an ink jet recording apparatus, according to claim 1, wherein said spacer compresses, at least, an area of said porous member facing said ink supply port.

[Claim 5] The ink cartridge for use with an ink jet recording apparatus, according to claim 1, wherein said spacer is formed by a tabular base on the side facing said lid member, and by ribs stretching in the longitudinal direction of said container on the side facing said porous member.

[Claim 6] The ink cartridge for use with an ink jet recording apparatus, according to claim 5, wherein a projection that can engage said lid member is formed on said tabular base side facing said lid member.

[Claim 7] The ink cartridge for use with an ink jet recording apparatus, according to claim 1, wherein said spacer is formed by a tabular base on the side facing said lid member, and by multiple ribs stretching in the longitudinal direction of said container, on the side facing said porous member, with connecting ribs formed between adjacent interrelated ribs.

[Claim 8] The ink cartridge for use with an ink jet recording apparatus, according to claim 1, wherein said ribs are formed in positions on both sides of the width direction of said container body.

[Claim 9] The ink cartridge for use with an inkjet recording apparatus, according to claim 1, wherein a convex portion is formed, providing an ink flow path communicating to said ink supply port, projecting from the bottom of said container body to said ink supply port, said ribs contact said porous member at the area not facing said ink flow path.

[Claim 10] The ink cartridge for use with an inkjet recording apparatus, according to claim 5, wherein a projection is formed, which is capable of making contact with the inner wall of said container body, at the longitudinally directed angular portion of said base.

[Claim 11] The ink cartridge for use with an inkjet recording apparatus, according to claim 1, wherein said spacer is structured with a tabular base at the side facing said lid member, and with ribs provided with a convex portion, stretching in the longitudinal direction of said container at the side

facing said porous member, formed in the area facing said ink supply port.

【請求項１２】
[Claim 12] The ink cartridge for use with an ink jet recording apparatus, according to claim 8, wherein said base is formed on the side facing said base, and a projection is formed pressing said porous member to said ink supply port side.

[Claim 13] The ink cartridge for use with an inkjet recording apparatus, according to claim 1, wherein said container body is partitioned into multiple ink chambers communicating with the ink supply port, by walls, and said porous members in each of said chambers are inserted and pressed by said spacer to said ink supply port.

[Claim 14] The ink cartridge for use with an inkjet recording apparatus according to claim 1, wherein a memory device recording data for specifying the ink cartridge is attached to said container body or lid member.

[Detail Description of the Invention]
[0001]
[Field of the Art]
The invention relates to an ink cartridge for supplying ink to a recording head. The ink cartridge is mounted on a carriage in which a recording head for jetting ink droplets is attached.

[0002]
[Related Art]
An ink jet recording apparatus prints images of photo-like quality with a relatively simple structure, so that it is widely used as a recording apparatus for personal use. In such a recording apparatus, recording heads for a black ink and color inks are generally mounted on a carriage, then cartridges for the black ink and the color inks are installed thereon, thereby the inks are supplied to each recording head via an ink supply needle.

[0003]
[Problem to be solved by the invention]
In the case that most of the printing to be printed by the recording apparatus is composed of text data, the amount of the color inks to be used is little and the color inks are not frequently used, so that the frequency of an exchange of the color ink cartridge is much lower than that of the black ink cartridge. Accordingly, there is a problem that the effective data of the color ink cartridge expires before the consumption of all of the color inks, which requires the premature replacement of the color ink cartridge, there by increasing the cost. On the other hand, when color printing is often conducted, the black ink is not frequently used, and the effective date may expire before consuming all of the ink in the black cartridge. Moreover, when the recording apparatus itself is not used frequently, the effective date expires when the inks remain in both black and color ink cartridges. In order to solve the above-mentioned problem, an ink cartridge may be produced by decreasing the volume of the ink cartridge. However, a gap is generated between the ink cartridge and a holder housing the ink cartridge, so that a distortion may be generated by the reciprocating carriage at a connecting portion between the ink supply needle and an ink supply port. Also, a new metallic mold is necessary, thereby increasing costs.In order to solve those problems, as shown in Japanese published application no. 9-262988, a filler is inserted in the bottom of a container body composing an ink cartridge with a normal volume so as to decrease the amount of filled ink.According to the reference, just filling the filler in the container body makes the amount of the filled ink decrease without changing a shape of the container. However, a shape adjacent to an ink supply port is changed, which greatly affects the outflow characteristics of ink to the recording head. Therefore, the printing characteristics may fluctuate.It is an object of the present invention to provide an ink cartridge with a small volume, which has the same characteristics of ink discharge as those of an ink

cartridge with a normal volume.

[0004]
[Means for solving problem]
In order to solve these problems, in the present invention, a spacer is inserted in the gap between a lid member and a porous member in an ink cartridge. This ink cartridge comprises from a container body that stores said porous member for absorbing and holding ink in the ink chamber, communicating via the ink supply port, and said lid member that seals the opening portion of said container body.

[0005]
[Effect]
The same dimension of a lid member and a container storing a normal amount of ink is used, . No change is produced to the structure adjacent to the ink supply port, or to the relationship between the porous member and the supply port. The volume of the porous member that stores ink is thus decreased.

[0006]
[Embodiment of the invention]
What follows is an explanation based on an embodiment illustrating the details of the invention. Fig. 1 shows one example of an ink cartridge for black ink with a normal volume, the reduction of which is the intent of this invention. A cartridge 1 is composed of a container body 3, made from high polymer forming an ink chamber 2 in order to secure a substantially parallelepiped space, and a lid member 4 that seals the opening portion of the container body 3. At one side of the container body 3, an ink supply port 5 is formed, engaging the ink supply needle 22 communicating to the recording head 20 at a lower surface 3a in this embodiment. A porous material 6 with a substantially parallelepiped shape for absorbing, holding and storing the ink is inserted into the container 3.

[0007]
Also, at the other surface adjacent to where the ink supply port 5 is formed, a memory device for storing information regarding a cartridge, such as manufacturing number, the date of manufacture, ink volume, and so on, is installed to the inner surface. Also, a circuit board 8 is installed , formed with electrodes 7 for communicating outside on the surface.

[0008]
The lid member 4 has ribs 9 formed on the back surface to ensure a gap between the porous member 6 and the lid member. Also, an ink injecting port 10 for injecting ink to the porous member, and an air communicating port 11 communicating with said gap space are bored. Also, on the back surface of the lid member 4, a narrow groove 12 is formed so as to form one edge that extends to the air communicating port 11, and another edge that extends to another area.

[0009]
Fig. 2 shows the internal structure of the above ink cartridge 1. When the ink cartridge 1 is mounted on a carriage 21 fixing a recording head 20 at a predetermined position, an ink supply needle 22 which communicates with the recording head 20 makes a fluid-tight connection with an ink chamber 2 via a ink supply port 5. The ink supply needle 22 is easily attached to or removed from the ink supply port 5. When the ink supply needle 22 is inserted into the ink supply port 5, the ink supply needle 22 is assured to be sealed with a packing 13.

[0010]
Above the packing 13, a convex portion 15 having an ink flow path 14 is formed at the side of the ink chamber, and is constantly pressed into the ink flow path 14 by a spring 16. A valve body 17 is installed which opens when the ink supply needle 22 is inserted into a predetermined position. When the ink supply needle 22 is not inserted, the valve is formed to prevent ink leakage by pressing into

the upper surface of packing 13.

[0011]
In such a constructed ink cartridge 1, a rectangular parallelepiped porous member 6 is inserted into the ink chamber 2 of the container body 3, and an opening portion of the container body 3 is joined the lid member 4 with fuse bonding so as to seal. On an exposed surface of the ink supply port 5, a film (not-shown) is attached so as to be torn by inserting the ink supply needle 22.

[0012]
In such sealed condition, when the pressure inside of the container body is reduced by connecting an discharging pipe with an air communicating port 11 of the lid member 4 and inserting an ink injecting needle into the porous member 6 from an ink injecting port 9, air in a flow path of the ink supply port 5 and in internal space of the porous member 6 is removed.

[0013]
In this condition, when ink is injected via the ink injecting needle, the ink is effectively absorbed into the internal space of the porous member 6. After completion of the ink filling, the ink cartridge is housed in a reduced pressure chamber and pressure is further reduced. Then a sealing film 18 with the removable part 18a is attached to the upper surface of lid member 4 to complete the ink cartridge 1.

[0014]
On the other hand, when producing an ink cartridge with a small volume, a second porous member 6' is inserted into the ink cartridge. The porous member 6' has substantially the same cross sectional shape as the porous member 6 as shown in Fig. 4. However, the height H' of the porous member 6', according to the ink amount, is smaller than the height H of the porous member 6 of an ink cartridge with normal cartridge.

[0015]
A spacer 30 is composed of a base 33 having protrusions 31 and 32 at both edges in the longitudinal direction and adjacent to the ends of both sides as shown in Fig. 5. The spacer 30 is further comprised of ribs 34 and 35, which extend in the longitudinal direction.

[0016]
These ribs 34 and 35 are formed in two rows at both sides so as to be positioned inside of the base 31. Both edges of ribs 35 positioned at the side of centerline protrude further than ribs 34 which are positioned at outside. Also, the ribs 35 are positioned inside of the protrusions 31 of the base 33. Both side surfaces 35a are formed as a slope so as to make the upper part of the board face outside.

[0017]
Ribs 34 and 35 are joined together by ribs 36, which are perpendicular to ribs 34 and 35. The protrusions 32 at both sides are joined to ribs 34 by ribs 37 having slopes 37a, formed in the gap with the outer side of ribs 34. Ribs 36 maintain a proper gap between the ribs 34 and 35, the gap being to prevent ink from being absorbed between the ribs 34 and 35 by capillary action and to prevent entered ink from being stagnant due to its meniscus, and at the same time to give rigidity in order to maintain the whole shape of the spacer 30. A number of ribs are prepared depending on necessity.

[0018]
In the base 33, through holes 38, 39, 38' and 39' are provided at positions facing, at least, the ink injecting port 10 of the lid member 4 and also when necessary the air communicating port 11. The through holes are set to be symmetric with respect to each other. The projections 40 are formed at both edges of the longitudinally directed protrusions 3l, and 31. The projections 40 make strong contact with the inside of the container body due to friction force and function to keep the porous

member 6 compressed until the container body 3 and the lid member 4 are joined.

[0019]
After inserting the second porous member 6' into the container body 3, such a constructed spacer 30 is inserted into the container body 3 with the ribs 34 and 35 face down. When the lid member 4 covers the opening portion 3a of the container body 3 and is pressed, the porous member 6' is compressed by the lid member 4 via the spacer 30, and moves towards the bottom of the container body 3.

[0020]
In the spacer 30, the through holes 38 and 39, and 38' and 39' are formed so as to be symmetric with respect to each other. Therefore, even if the spacer 30 is inserted with the left and right sides reversed, either the through hole 38 or 38' correspond to the ink injecting port 9, so that further ink filling is not prevented. The ribs 34 and 35 are set at both sides so as to be positioned in the vicinity of the internal wall of the container body 3. Therefore, it is possible to squeeze the porous member 6' toward the bottom of the container body 3, which rises easily through friction generated between the porous member and the internal wall. Also, the spacer 30 does not prevent the insertion of the ink injecting needle.

[0021]
After the stage in which the spacer 30 and the porous member 6' are set, both projections 40 of the protrusions 31 and 31 make strong contact with the internal wall of the container body 3 as shown in Fig. 6(a) so as to prevent the rise of the porous member. Under this condition, the opening portion 3a of the container body 3 is sealed with the lid member 4 by fuse bonding. Also, the exposed surface of the ink supply port 5 is sealed with a film that can be penetrated by the ink supply needle 22, completing the container.

[0022]
In addition, the air communicating port 11 of the container is connected with a discharging pipe, and an ink injecting needle is inserted into the porous member 6' from the ink injecting port 10. Passing through the through holes 38 of the spacer 30 and the gap between ribs 35 and reaching the porous member 6', the leading edge of the ink injecting needle is inserted into the porous member 6'. Under this condition, when the pressure is reduced in the interior of the container by the discharging pipe, the air in the flow path of the ink supply port 5 and in the internal space of the porous member 6' is removed.

[0023]
After that, when a volume of ink which is absorbable by the volume of the second porous member 6' is injected by the ink injecting needle, the ink is absorbed in internal space of the porous member 6'. When ink filling is completed, pressure is further reduced by storing the ink cartridge in a pressure reduced chamber. Then, the sealing film 18 having the removable part 18a is attached to the upper surface of lid member 4, completing the ink cartridge.

[0024]
In addition, a memory device provided on a circuit board 8 stores information specifying the ink cartridge as well as data related to the amount of ink decreased by the spacer 30.

[0025]
In such an ink cartridge 1' with a small volume, since the porous member 6', is compressed by the ribs 34 and 35 from above, in comparison with pressure from the base, the porous member 6' receives an appropriate degree of pressure corresponding to the internal shape and in particular the shape of the convex portion 15. Also, as the ribs 35 are positioned substantially outside of the convex portion 15, flow resistance of the ink flow path of the ink supply port is not increased unnecessarily.

[0026]
When the ink cartridge 1' is mounted on a recording apparatus as shown in Fig. 6, the ink supply needle 22 makes a fluid-tight connection with the ink chamber 2 via the ink supply port 5. The vicinity of the ink supply port 5, which has a major effect on the supply characteristics of ink sent to the recording head 20, in particular, the porous member 6' around the convex portion 15, is compressed by the spacer 30 in the same manner as in the ink cartridge with a normal volume. Accordingly, ink is assuredly supplied to the recording head 20 regardless of the amount of ink filled.

[0027]
In the above-mentioned embodiment, the spacer is formed so as to be symmetric. However, as shown in Fig. 7 (a), when convex portions 34a and 35a are formed in the area facing the ink supply port of ribs 34 and 35, formed by the spacer 30, the vicinity of the ink supply port 5 is selectively compressed as shown in Fig. 7 (b), so that discharge of ink to the ink supply port 5 from the vicinity can be ensured. In addition, when a perpendicular wall 41 is formed at a position slightly towards the center at the edge portion of the spacer away from the ink supply port 5, the area furthest from the ink supply port 5, namely the upper edge area, is pressed toward the ink supply port 5 side, further ensuring that the ink in the absorbing member 6 is lead to the ink supply port 5.

[0028]
In the above-mentioned embodiment, ribs 9 of the lid member 4 make contact with the base 33. However, as shown in Fig. 8 (a), wall shape projections 42 and 43 are formed so as to engage the ribs 9 surrounding the air intake port 11 and the ink injecting port 10 on the upper surface of the base 33. Further, projections 44 and 45 are formed, engaging in the gap of the lid member 4 ribs. This ensures that the spacer 30 is constantly pressed against the porous member 6' despite of the convex portions 34a and 35a of the ribs 34 and 35.

[0029]
In the above-mentioned embodiment, an example is given in which the ink supply port 5 is sealed via the valve body 17, which can be opened by the ink supply needle. However, providing only a packing that engages the ink supply needle with an air tight has the same effect.

[0030]
In the above-mentioned embodiment, an example is given in which the ink cartridge stores one color ink. However, as shown in Fig. 9, the same effect may be had by dividing the container body 3 into a plurality of ink chambers 2 with walls 3a, and storing porous members 6'' and spacers 30' in each.

[0031]
[Effect of the invention]
As explained above, in the present invention, because a spacer for pressing a porous member to an ink supply port is inserted between a lid member and the porous member, the volume for storing ink is decreased without changing the structure in the vicinity of the ink supply port by using the same container body and the same lid member which are used for an ink cartridge with a normal volume.

[Brief explanation of the drawings]
Fig. 1 shows one embodiment of the ink cartridge of this invention.

Fig. 2 shows a cross sectional structure view of the ink cartridge illustrated in Fig.1, installed to a recording apparatus.

Fig. 3 is a perspective assembly view showing one embodiment of the ink cartridge illustrated in Fig.1.

Fig. 4 is a perspective assembly view showing one embodiment when the ink cartridge illustrated in Fig.1 is constructed as a small-volume type.

Fig. 5 is a perspective view showing one embodiment of the spacer, installed in the ink cartridge in Fig.1, the condition viewed from the side of the porous member.

Figs. 6 (a) and (b) are cross sectional views showing the condition in which the small-volume type ink cartridge in Fig.1 is installed to a recording apparatus.

Figs. 7 (a) and (b) are a perspective view showing another embodiment of the spacer installed to the ink cartridge, viewed from the side of the porous member, and a view showing the cross sectional structure of the ink cartridge to which this spacer has been installed.

Figs. 8 (a) and (b) are perspective drawings showing another embodiment of the spacer inserted to the ink cartridge, viewed from the lid member side, and a view showing the cross sectional structure of the ink cartridge to which this spacer has been inserted.

Fig. 9 is a view showing another embodiment of this invention, an example in which the cartridge is for color ink, with the lid member removed.

[Explanation of symbols]
1. Cartridge
2. Ink chamber
3. Container
4. Lid member
5. Ink supply port
6, 6'. Porous member
9, Rib
10. Ink injecting port
11. Air communicating port
13. Packing
15. Convex portion
20. Recording head
22. Ink supply needle
30. Spacer
31,32. Protrusion
33. Base
34,35. Rib
38, 39, 38',39'. Through holes

[Abstract]
[Object]
The present invention provides an ink cartridge that has same functions as a normal ink cartridge but can reduce manufacturing costs as much as practicable.
[Means for solving problem]
It is comprised of a container body 3 that stores a porous member 6', which absorbs and holds the ink, and a lid member 4. A spacer 30 is inserted in the gap between the lid member 4 and the porous member 6', which can compress the porous member 6' towards an ink inlet port 5. The volume for storing ink is decreased without changing the structure in the vicinity of the ink supply port, using the same container body and lid member that are used for an ink cartridge with a normal volume.